

WHAT IS CLAIMED IS:

Sub A¹ 1. A clay-polymer nanocomposite comprising an organoclay which has been
2 exfoliated into a polymer matrix, the organoclay being the reaction product of a
3 smectite clay with a quaternary ammonium compound which comprises a diester quat.

4 2. The nanocomposite of claim 1, wherein the organoclay is the reaction
5 product of a smectite clay with a diester quat in admixture with further quaternary
6 ammonium compounds having esterified radicals.

1 3. The nanocomposite of claim 1, wherein the diester quat is in admixture with
2 further quaternary ammonium compounds which are selected from one or more
3 members of the group consisting of triester and monoester quats.

1 4. The nanocomposite of claim 1, wherein the diester quat is present as
2 greater than 55 wt% of the quaternary mixture.

Sub A² 1 5. The nanocomposite of claim 4, wherein any triester quat comprises less
2 than 25 wt% of the quaternary mixture.

1 6. The nanocomposite of claim 5, wherein the fatty acids corresponding to
2 the esters in the quaternary mixture have a degree of unsaturation such that the iodine
3 value ("IV") is from about 20 to about 90.

Sub A 23

1 7. The nanocomposite of claim 6, wherein the diester quat content is greater
 2 than 60 wt%, the triester quat content is less than 20 wt%, and the IV is from about 30
 3 to about 70.

1 8. The nanocomposite of claim 7, wherein the diester quat content is greater
 2 than 62%, the triester quat content is less than 17 wt%, and the IV is from about 40 to
 3 about 60.

1 7. The nanocomposite of claim 8, wherein the IV is from about 45 to about
 2 58.

Sub A 3

1 10. An organoclay useful in preparing clay-polymer nanocomposites
 2 comprising the reaction product of a smectite clay with a quaternary ammonium
 3 compound which comprises a diester quat in admixture with further quaternary
 4 ammonium compounds having esterified radicals.

1 11. The organoclay composition of claim 10, wherein the diester quat is in
 2 admixture with further quaternary ammonium compounds which are selected from
 3 one or more members of the group consisting of triester and monoester quats.

1 12. The organoclay composition of claim 11, wherein the diester quat is
 2 present as greater than 55 wt% of the quaternary mixture.

Sub A 4

1 13. The organoclay composition of claim 12, wherein a triester quat is present
 2 and comprises less than 25 wt% of the quaternary mixture.

3 14. An organoclay composition in accordance with claim 13, wherein the
 4 quaternary ammonium compound is the reaction product of C₁₂ - C₂₂ fatty acids or the

5 hydrogenation products thereof, or a mixture of such acids, with an alkanolamine in
 6 the presence of an acid catalyst, wherein the ratio of fatty acid to alkanolamine is from
 7 about 1.40 to 2.0.

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1 15. The organoclay composition of claim 14, wherein the fatty acids
 2 corresponding to the esters in the quaternary mixture have a degree of unsaturation
 3 such that the iodine value ("IV") is from about 20 to about 90.

1 16. The organoclay composition of claim 15, wherein the diester quat content
 2 is greater than 60 wt%, the triester quat content is less than 20 wt%, and the IV is
 3 from about 30 to about 70.

1 17. The organoclay composition of claim 16, wherein the diester quat content
 2 is greater than 62%, the triester quat content is less than 17 wt%, and the IV is from
 3 about 40 to about 60.

1 14 18. The organoclay composition of claim 17, wherein the IV is from about 45
 2 to about 58.

1 15 19. The organoclay composition of claim 18, wherein the smectite is selected
 2 from the group consisting of hectorite, montmorillonite, bentonite, beidellite, saponite,
 3 stevensite and mixtures thereof.

1 16 20. The organoclay composition of claim 19, wherein the smectite comprises
 2 hectorite.

1 21. In the method for preparing a nanocomposite, by treating a smectite clay,
 2 with an organic ammonium ion to intercalate the organic molecule between the

23

3 silicate layers of the clay, thereby substantially swelling or expanding the interlayer
4 spacing of the smectite; and exfoliating the expanded silicate layers in the presence of
5 or with the assistance of a polymer with which reactive groups on the intercalated
6 organic molecule are compatible, or in the presence of a monomer which is
7 polymerized after being intermixed with the intercalated clay; the improvement which
8 enables very high efficiency in the said exfoliation, comprising:
9 utilizing as the source of the organic ammonium ion a quaternary ammonium
10 compound which comprises a diester quat.

1 22. The method of claim 21, wherein the diester quat is in admixture with
2 further quaternary ammonium compounds having esterified radicals.

1 23. The method of claim 22, wherein the diester quat is in admixture with
2 further quaternary ammonium compounds which are selected from one or more
3 members of the group consisting of triester and monoester quats.

1 24. The method of claim 23, wherein the diester quat is present as greater than
2 55 wt% of the quaternary mixture.

1 25. The method of claim 23, wherein a triester quat is present and comprises
2 less than 25 wt% of the quaternary mixture.

1 26. The method of claim 25, wherein the quaternary ammonium compound is
2 the reaction product of C₁₂ - C₂₂ fatty acids or the hydrogenation products thereof, or a
3 mixture of such acids, with an alkanolamine in the presence of an acid catalyst,
4 wherein the ratio of fatty acid to alkanolamine is from about 1.40 to 2.0.

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5 27. The method of claim 26, wherein the fatty acids corresponding to the
6 esters in the quaternary mixture have a degree of unsaturation such that the iodine
7 value ("IV") is from about 20 to about 90.

1 28. The method of claim 27, wherein the diester quat content is greater than
2 60 wt%, the triester quat content is less than 20 wt%, and the IV is from about 30 to
3 about 70.

1 29. The method of claim 28, wherein the diester quat content is greater than
2 62%, the triester quat content is less than 17 wt%, and the IV is from about 40 to
3 about 60.

1 30. The method of claim 29, wherein the IV is from about 45 to about 58.

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